

Please check the examination details below before entering your candidate information

Candidate surname

Other names

Centre Number

Candidate Number

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Pearson Edexcel International Advanced Level

Time 1 hour 30 minutes

Paper
reference

WFM01/01



Mathematics

International Advanced Subsidiary/Advanced Level Further Pure Mathematics F1

You must have:

Mathematical Formulae and Statistical Tables (Yellow), calculator

Total Marks

**Candidates may use any calculator permitted by Pearson regulations.
Calculators must not have the facility for symbolic algebra manipulation,
differentiation and integration, or have retrievable mathematical formulae
stored in them.**

Instructions

- Use **black** ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions and ensure that your answers to parts of questions are clearly labelled.
- Answer the questions in the spaces provided
– *there may be more space than you need*.
- You should show sufficient working to make your methods clear.
Answers without working may not gain full credit.
- Inexact answers should be given to three significant figures unless otherwise stated.

Information

- A booklet 'Mathematical Formulae and Statistical Tables' is provided.
- There are 9 questions in this question paper. The total mark for this paper is 75.
- The marks for **each** question are shown in brackets
– *use this as a guide as to how much time to spend on each question*.

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.
- If you change your mind about an answer, cross it out and put your new answer and any working underneath.

Turn over ►

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1.

$$\mathbf{M} = \begin{pmatrix} 3x & 7 \\ 4x+1 & 2-x \end{pmatrix}$$

Find the range of values of x for which the determinant of the matrix \mathbf{M} is positive.

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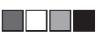
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Question 1 continued

Q1

(Total 5 marks)



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2. The complex numbers z_1 and z_2 are given by

$$z_1 = 3 + 5i \quad \text{and} \quad z_2 = -2 + 6i$$

- (a) Show z_1 and z_2 on a single Argand diagram. (2)

- (b) Without using your calculator and showing all stages of your working,

(i) determine the value of $|z_1|$ (1)

(ii) express $\frac{z_1}{z_2}$ in the form $a + bi$, where a and b are fully simplified fractions. (3)

(c) Hence determine the value of $\arg \frac{z_1}{z_2}$

Give your answer in radians to 2 decimal places.

(2)



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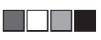
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Q2

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3. The parabola C has equation $y^2 = 18x$

The point S is the focus of C

- (a) Write down the coordinates of S

(1)

The point P , with $y > 0$, lies on C

The shortest distance from P to the directrix of C is 9 units.

- (b) Determine the exact perimeter of the triangle OPS , where O is the origin.

Give your answer in simplest form.

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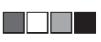
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Q3

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4. The equation

$$x^4 + Ax^3 + Bx^2 + Cx + 225 = 0$$

where A , B and C are real constants, has

- a complex root $4 + 3i$
- a repeated positive real root

(a) Write down the other complex root of this equation.

(1)

(b) Hence determine a quadratic factor of $x^4 + Ax^3 + Bx^2 + Cx + 225$

(2)

(c) Deduce the real root of the equation.

(2)

(d) Hence determine the value of each of the constants A , B and C

(3)

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Q4

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5.

$$\mathbf{P} = \begin{pmatrix} \frac{1}{2} & -\frac{\sqrt{3}}{2} \\ \frac{\sqrt{3}}{2} & \frac{1}{2} \end{pmatrix}$$

The matrix \mathbf{P} represents the transformation U

- (a) Give a full description of U as a single geometrical transformation.

(2)

The transformation V , represented by the 2×2 matrix \mathbf{Q} , is a reflection in the line $y = -x$

- (b) Write down the matrix \mathbf{Q}

(1)

The transformation U followed by the transformation V is represented by the matrix \mathbf{R}

- (c) Determine the matrix \mathbf{R}

(2)

The transformation W is represented by the matrix $3\mathbf{R}$

The transformation W maps a triangle T to a triangle T'

The transformation W' maps the triangle T' back to the original triangle T

- (d) Determine the matrix that represents W'

(3)

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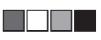
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Q5

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blank**6. The quadratic equation**

$$Ax^2 + 5x - 12 = 0$$

where A is a constant, has roots α and β

(a) Write down an expression in terms of A for

(i) $\alpha + \beta$

(ii) $\alpha\beta$

(2)

The equation

$$4x^2 - 5x + B = 0$$

where B is a constant, has roots $\alpha - \frac{3}{\beta}$ and $\beta - \frac{3}{\alpha}$

(b) Determine the value of A

(3)

(c) Determine the value of B

(3)



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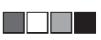
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7. In this question you must show all stages of your working.

Solutions relying entirely on calculator technology are not acceptable.

The rectangular hyperbola H has equation $xy = 36$

The point $P(4, 9)$ lies on H

- (a) Show, using calculus, that the normal to H at P has equation

$$4x - 9y + 65 = 0 \quad (4)$$

The normal to H at P crosses H again at the point Q

- (b) Determine an equation for the tangent to H at Q , giving your answer in the form $y = mx + c$ where m and c are rational constants.

(5)

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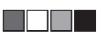
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8.

$$f(x) = 2x^{-\frac{2}{3}} + \frac{1}{2}x - \frac{1}{3x-5} - \frac{5}{2} \quad x \neq \frac{5}{3}$$

The table below shows values of $f(x)$ for some values of x , with values of $f(x)$ given to 4 decimal places where appropriate.

x	1	2	3	4	5
$f(x)$	0.5		-0.2885		0.5834

- (a) Complete the table giving the values to 4 decimal places. (2)

The equation $f(x) = 0$ has exactly one positive root, α .

Using the values in the completed table and explaining your reasoning,

- (b) determine an interval of width one that contains α . (2)

- (c) Hence use interval bisection twice to obtain an interval of width 0.25 that contains α . (3)

Given also that the equation $f(x) = 0$ has a negative root, β , in the interval $[-1, -0.5]$

- (d) use linear interpolation once on this interval to find an approximation for β .

Give your answer to 3 significant figures.

(3)

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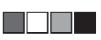
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9. (a) Prove by induction that, for $n \in \mathbb{N}$

$$\sum_{r=1}^n r^3 = \frac{1}{4} n^2(n+1)^2 \quad (5)$$

- (b) Using the standard summation formulae, show that

$$\sum_{r=1}^n r(r+1)(r-1) = \frac{1}{4} n(n+A)(n+B)(n+C)$$

where A , B and C are constants to be determined.

(4)

- (c) Determine the value of n for which

$$3 \sum_{r=1}^n r(r+1)(r-1) = 17 \sum_{r=n}^{2n} r^2 \quad (5)$$

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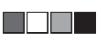
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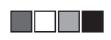
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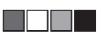
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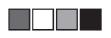
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Q9

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TOTAL FOR PAPER: 75 MARKS



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